

# THE PRACTICE OF INNOVATION: INNOVATION AS THE MANAGEMENT OF CONSTRAINTS

*At Pitney Bowes, innovation is managed not by funneling ideas through gates to sift the worthy from the unworthy, but by managing constraints in a process driven by customer needs.*

James Euchner and Austin Henderson

**OVERVIEW:** *Successful innovation requires the management of multiple contexts: those of the customer, the offering itself, the business model for the offering, and the strategic aims of the hosting corporation. An approach to managing these contexts and the constraints they impose was developed and implemented at Pitney Bowes. Although it is designed to manage multiple constraints, the approach is based on a deep and continuing reliance on the customer for direction. In this paper, the constraint-driven process is discussed and examples of innovation based on the approach are reviewed.*

**KEY CONCEPTS:** *Innovation, Customer-centered innovation, Participatory design*

Many theories about innovation are based on a belief in the brilliant idea—the assumption that at the heart of any successful innovation is the great idea, the inspiration, the spark of genius, a moment of insight (Aha!)

born of a technological advance. This assumption goes hand in hand with another: that the business challenge of innovation is selecting among alternative ideas to weed out those that are not worthy of further investment, and to nurture through to product development those that are most compelling. Many corporate innovation processes are designed around this assumption: they focus on generating a collection of ideas at the outset and then qualifying, filtering, elaborating, promoting, and developing a few of these ideas. The process is often depicted as a multistage funnel that includes a variety of means for canvassing the organization for ideas and a formal gating process for successively filtering the ideas, thereby limiting the investment in “weak ideas” and increasing commitment to a few good ideas as the funnel narrows (Cooper and Edgett 2007; Laffley and Charan 2008). The funnel is a model built around the notion that the brilliant idea is the critical enabler of innovation (Figure 1).

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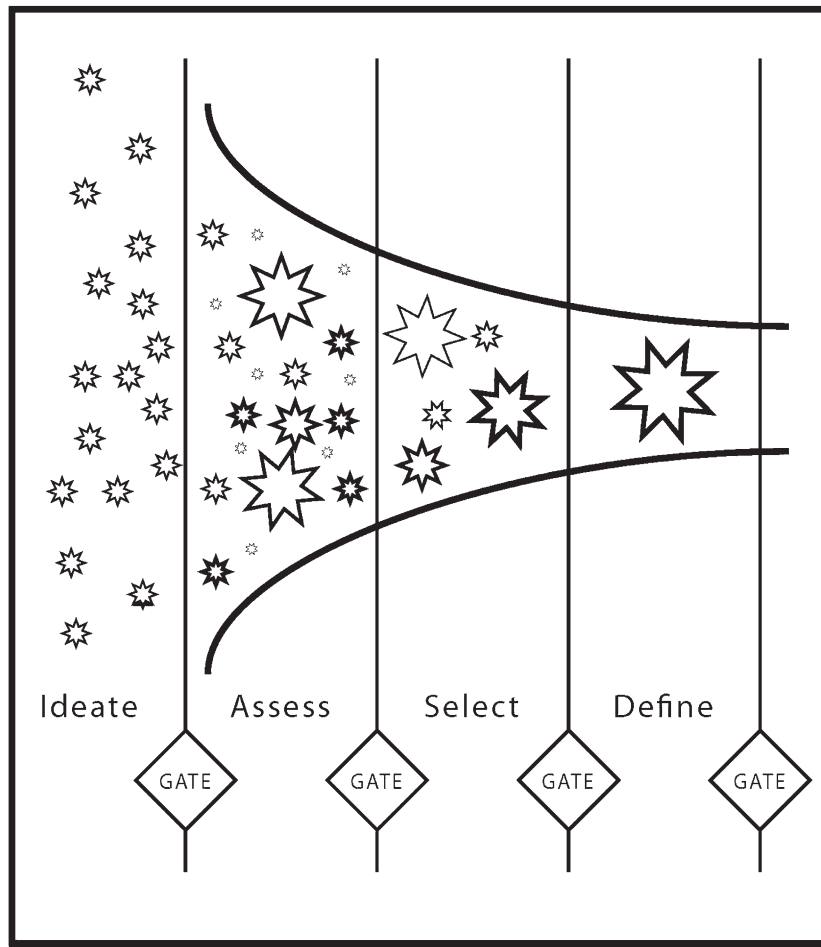


Figure 1.—The funnel model.

Unfortunately, this just isn't how innovation usually works. Dig deeply and honestly into the history of a new product's evolution and you will usually find a very different story, one of tacit insights, cross-organizational communication, and serendipitous events. Frequently, a raw idea (or several) that had been kicking around the organization will be drawn into the mix and become modified by its new context of consideration. These stories of innovation are not about filtering for great ideas, but about people creating and managing a series of constraints to nurture an innovation. Through accident or skill, these constraints—and the interactions among them—have been resolved in a way that enables business success.

At Pitney Bowes, we implemented a process that manages innovation by systematically navigating a shifting landscape defined by four constraints: the strategy and capabilities of the business, the needs and values of the target customers, the potential of emerging technologies, and raw economics. Each of these constraints overlaps the others, creating what we call an "innovation clover"

(Euchner 2003). The story of a successful new product or service is the story of a continual search for the sweet spot on the innovation clover, the zone where all of the constraints have been satisfied (Figure 2). Rather than a narrowing funnel, our approach relies on a contracting spiral, a systematic tightening of the constraints of innovation in the way that lug nuts are tightened on the wheel of a car: sequentially and iteratively. Over a four-year period, the approach more than doubled the rate at which new products and concepts emerged from the research labs into product development.

### Managing Constraints

The process of creating new product or service concepts is messy, noisy, and nonlinear, but it need not be haphazard. It is possible to define a set of repeatable steps toward the goal (with the caveat that, at times, the innovators must take two steps back to find three steps forward). The constraint-based approach can be implemented in five steps, each of which layers in a new set of concerns and serves to constrain the opportunity space a

little further (Figure 3). Each of the first four of these steps has a primary focus on one leaf of the innovation clover; the final step validates the results gathered in the previous steps. It is the iteration among the steps that enables movement toward the sweet spot at the center of the clover.

1. **Start with a strategic question.** By identifying a market of interest and the significant trends shaping that market space, the strategic question defines the boundaries within which to look for opportunity. Because the boundaries reflect the strategic intent of the business unit, they constrain the concepts that emerge to those that might match the firm's capabilities and interests.
2. **Focus on understanding customer needs.** Customer needs, wants, and values are the defining constraint of the innovation process; without them, there is no business. It is crucial to seek to understand the world from the perspective of the target customer *before* locking on to solutions. This may well be the most difficult step of the process; it takes discipline and structure to focus on fully understanding problems and needs without jumping directly to solutions.
3. **Invent into customer needs.** Clearly defined needs provide the perfect foil for inventors. Inventing into customer needs entails brainstorming for new concepts that could radically change the way customer needs are being met. Doing this well requires a foundation of technical strengths in relevant areas.
4. **Create new value propositions.** A value proposition will solve a whole problem for users and do so in a way that creates enough value to justify its adoption. It goes

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beyond the product or service itself and encompasses all aspects of the new user experience. Lanning (1998) and Phillips (2001) offer fuller definitions of the concept of a value proposition. To develop value propositions, a team should focus on the most compelling customer needs that have been identified and the most novel ways for satisfying them. A successful value proposition is likely to aggregate a variety of needs and concepts in order to create a coherent solution.

5. **Test and refine the value proposition in use.** Any significant new value proposition must be tested with real people in realistic settings. This is required to

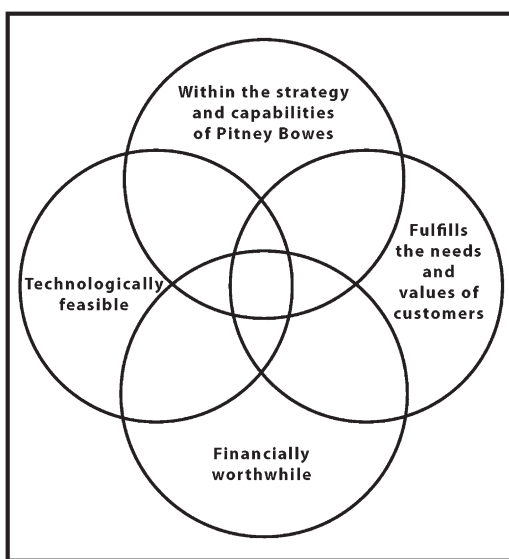


Figure 2.—The innovation clover.

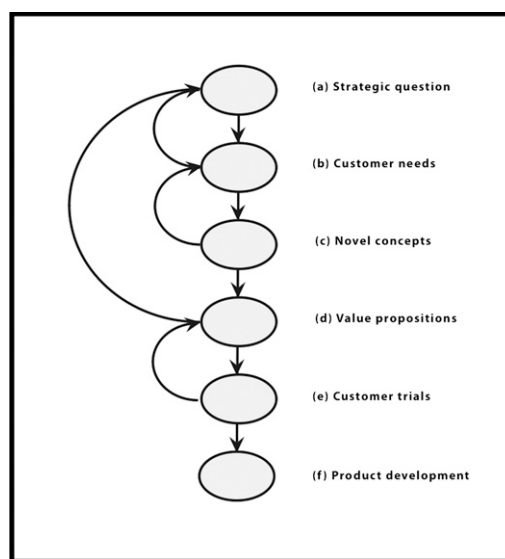


Figure 3.—Managing context.

assure that the offering works in practice and that it delivers the promised value in the target customer's world. It will likely be necessary to use early test results to refine not only the offering, but the way in which it is delivered to the customer.

Each of the steps through the process produces a better understanding of the existing constraints and the interactions among them. This new understanding inevitably leads to continued learning, and further iterations of previous steps, on the path to convergence.

### **Start With a Strategic Question: Define the Opportunity Space**

The constraint-driven process begins with a strategic question that defines the market space and identifies relevant trends that shape the space and make it of interest to the firm. For example, saturation of the traditional market for postal meters combined with an increased interest at postal services in reducing costs associated with stamps led Pitney Bowes's innovation unit to ask, "How can Pitney Bowes develop solutions to meet the needs of those currently paying for their postage with stamps?" Another strategic question was raised by the events of 9/11 and the subsequent anthrax scare: "What can Pitney Bowes do to help protect corporate mailrooms from hazards arriving in the mail?"

There are a few reasons for beginning with the strategic question. First, an innovative product or service is more likely to be successfully brought to market if it addresses an opportunity that the business really cares about—if it meshes with the firm's larger, driving strategy. Second, a well-framed strategic question will guide concepts toward those within the capabilities of the firm; many ideas falter because the organization does not have the wherewithal to bring them to market. Finally, the focus on a strategic question can help to orient innovators toward larger opportunities and defend against settling on the first good concept that comes along.

The strategic question is developed in a collaboration between the business and the innovation function. It must be narrow enough to be actionable and broad enough to encompass a large opportunity space. Defining a good strategic question is itself often an iterative endeavor.

### **Focus on Understanding Customer Needs: The Power of Outside-In Insight**

Once a strategic question is framed, a cross-functional team is formed with members having backgrounds in marketing, engineering, anthropology, and business strategy. The team begins by clarifying the opportunity space, which is examined from multiple angles in an effort to narrow the focus of the investigation while

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maintaining its strategic intent. Is the customer segment well enough defined? Is it too broad or too narrow? Is the business unit's strategic intent clear? What changes in the world make this question timely now? A careful understanding of the strategic question at the outset saves the effort of running down blind alleys.

Grounded by the context of a strategic question, the innovation team begins by exploring what people in the target customer's world are doing. They do this in the most logical of ways: by traveling to customer locations to observe people doing their jobs. This is a systematic endeavor, using tools borrowed from anthropology to collect and analyze qualitative information. The goal is to understand the customers' world from the perspective of those living in it. Christensen and Raynor (2003) refer to this as understanding the "jobs to be done."

One framework we use for the collection of data is called POSTA, for People, Objects, Settings, Time, and Activities (Jordan and Goldman 1994; personal communication, P. Sachs Chess, 2001). Using this model, a team may, for example, focus on a **person** in the work setting, following the person around and observing what he or she does and how he or she interacts with other people and tools in the environment. Or they may focus on key **objects** or artifacts in the environment, with special attention to the various roles that they play for the people

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who interact with them (functional, psychological, and social). During another observation, the team may take photographs of the work **setting** and try to understand how the configuration of space mediates the work. The “T” in POSTA refers to **time**—how activities vary under different predictable conditions that depend on time (for instance, during a rush period or a crisis). Finally, the team will often chart **activities**, including both formal workflow and informal work practices.

For example, in the “stamps” engagement, the team visited dozens of small businesses of all types, watching the principals and others work, observing their practices and attitudes around the preparation of mail, and talking to them about their frustrations and desires. In the “secure mail” engagement, the team visited larger enterprises, especially those with an intense interest in mail security. They watched how people in those settings handled the mail, learned about new processes the customers were experimenting with, asked who was to become involved in the event of an incident—and even had the opportunity to observe the reaction to a hoax. This world was far more varied than that of the stamps engagement, but systematic data collection was necessary in both.

As the observations accumulate, the team analyzes the results. Again, they use systematic practices borrowed from the fields of anthropology and design to facilitate and structure the analysis. These methods include mapping formal and informal work processes, coding field notes for tacit (unspoken) data, mapping social connections among participants, analyzing the language that people use in talking about their work, and looking for recurring patterns in activities. The goal is to identify compelling needs or values relevant to the strategic question.

In the stamps engagement, for instance, we found that small-business owners didn’t like to run out of stamps, hated to go to the post office to get more, didn’t understand (or care about) special services available from the post office, and valued things that made their mail distinctive. We also found that (at the time) they often did not have computers, and if they had them, did not want to tie them up with sending mail. As prevalent as these problems were, however, most small-business owners we observed were unwilling to pay very much to overcome them.

In the secure mail engagement, the most important needs were protecting the health of employees, protecting facilities from damage, and maintaining business continuity. There was also a concern about anticipating the next threat, and therefore a need to stay abreast of the latest developments in the field of mail security. Because securing the mail was a cost of doing business, with no immediate potential to increase revenues or reduce costs,

we also found strong ambivalence among customers about investing in secure mail solutions.

Once the needs are identified and clearly articulated, some may appear obvious; the difficulty is in identifying them from the field data and articulating them clearly. In practice, we find that what is most important to people is often below the surface and difficult to articulate. In many cases, real problems have been so thoroughly accommodated by workers and customers that they have receded into the background. It may be possible to identify these needs only later, during the analysis of field notes.

Developing a deep understanding of needs is an iterative, sometimes complex process requiring systematic, careful observation and thoughtful, open-minded analysis. But understanding needs is crucial, as this understanding is inextricably intertwined with the process of invention. A good set of needs serves both as constraint and as the agent for releasing creative energy.

### **Invent into Customer Needs: Prototypes as the Language of Innovation**

Each hypothesized need creates the opportunity for an inventive cycle: express the need; brainstorm solutions; embody the solutions in quick prototypes; and check understanding of the need by getting reactions to the prototypes from users in their work settings (Figure 4).

Needs, especially tacit needs, are hard to express in words and easy to misunderstand. Fortunately, everyone seems to have an immediate response to a *thing*. Our experience is that people are generally more positive in interviews about an idea than they are in interaction with a prototype embodying it, so we use a lot of prototypes. The team seeks to isolate specific needs identified in observations and embody them in novel and interesting

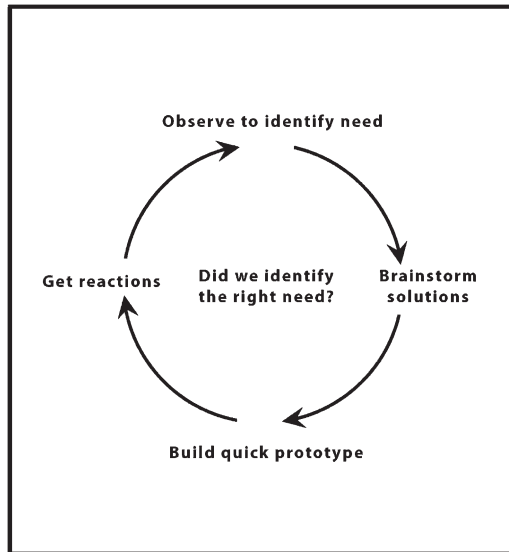


Figure 4.—Cycle for identifying needs.

prototypes. The goal is to assess the accuracy of our understanding of the underlying customer needs, not to test the market potential of a product concept. Kelley and Littman (2001) discuss this use of prototypes as the language of innovation and provide some guidance in developing them.

Structured brainstorming is a part of many innovation processes. What distinguishes the approach at Pitney Bowes is the focus and frequency of the brainstorming efforts. A typical project may conduct two or three brainstorming sessions a week at the early stages of a project. We focus a brainstorming session around a specific need or set of needs crystallized from the fieldwork we have done, for example around the desire for self-expression in mailing or the need to detect anthrax hoaxes. The usual process is to bring together a diverse group of participants, including people with relevant expertise who are not engaged directly with the project, and push to come up with 100 ideas in an hour. The brainstorming sessions are facilitated, and the facilitator attempts both to keep the session moving and to keep the focus on the targeted set of needs.

From the brainstorming sessions, the team will select compelling ideas to prototype. In the first round, prototypes are low-fidelity representations: a foam-core model, something made of cardboard, a storyboard. Their purpose is to probe the need, refine it, disconfirm it, or discover the underlying, incompletely expressed need. In one instance, for example, a crude prototype helped us discover that we had mistaken a need for privacy as a need for security. In another, a prototype we built that was designed to locate documents helped us understand that the customers thought of themselves as

losing folders (collections of documents), not individual documents.

The early prototypes clarify our understanding of customer needs. Customer responses to early prototypes in the stamps engagement helped us to understand that people wanted to retain some of the features of stamps that enabled them to personalize an envelope. We also understood that, without a scale and a way of determining how much postage was required, the device would be of much less value. Similarly, in the secure mail engagement, early prototypes clarified the need to communicate to recipients that a mail piece had been tested and to understand more deeply the need for a device that could be used with very little training and under stressful conditions.

Gathering disconfirming information requires an “egoless” sharing of the prototypes. The innovation team has to be trained to share the concepts, rather than promoting them, and to observe reactions and listen for things that they did not expect to hear. What is learned in these sessions is fodder for the next round of prototypes; prototyping continues until the team believes that they have really understood (or disconfirmed) a compelling need of the target customers.

In addition to solidifying the understanding of needs, prototypes frequently identify “inventive gaps”—technical capabilities that would be required to deliver what the customer really wants, but which require further work (and may not even be possible). We do not focus on these at this stage in the process, but come back to them once we have decided on the value proposition that we would like to offer to the customer.

### Create New Value Propositions: Innovation as Synthesis

Developing a value proposition from the mosaic of needs and user reactions to prototypes is a creative phase of the work. It requires arranging and rearranging the pieces, seeking a configuration that makes sense. It usually starts with a focus on the most compelling unmet need, but goes beyond that one need to the full set of requirements necessary to deliver a complete user experience. It requires an explicit analysis of the trade-offs between cost and benefit, selecting among the needs to be satisfied so that the solution is both coherent to the user community and worth the cost of delivery.

At this stage of development, the design process has tightened its focus to one proposed opportunity, a coherent set of needs to be met. At the same time, the context has also broadened to include thinking about all four aspects of the opportunity: user value, technological feasibility, business risks, and profitability. The design space has been kept manageable by balancing a narrowing focus with broadening concerns.

Once a value proposition has been articulated, there are typically open questions that must be addressed to fill in gaps in the user experience and to demonstrate feasibility. Some of these are technical and involve targeted research into solutions. Some of them relate to the market size and a customer's willingness to pay, and these require focused market research. Others relate to costs to deliver the solution and reach customers. Finding new ways of addressing these concerns—what might be called business model innovation—is usually as important as product innovation in bringing a compelling solution to market.

In the case of the stamps engagement, the value proposition was articulated as “a distinctive, easy-to-use replacement for stamps with a price point well below alternatives.” It had to have elements of fun as well as convenience and still be profitable for Pitney Bowes. This created a series of challenges, both technical and economic, and raised questions about the ability of our existing channels to achieve the desired volume levels. But each of these challenges was focused, and therefore amenable to analysis, testing, and solution.

In the secure mail engagement, the value proposition was summarized as “the ability to protect people and facilities from anthrax in the mail through isolation and detection of the threat.” The system had to be usable by mailroom personnel and could not create significant delays in mail processing. A significant challenge of the business was the fluctuating demand and willingness to pay as a function of external events. Each of these challenges, again, created focused areas for technology and business development.

### **Test and Refine the Value Proposition in Use: Will It Play in Peoria?**

Once a value proposition is well defined and shows promise as a viable, marketable offering, the team will seek to identify the key risks inherent in bringing it to market. Once risks are identified, the team undertakes the work necessary to retire those risks, through a sequence of trials with real users in the context of their work. These trials can be as simple as evaluations of usability *in situ*, or as elaborate as “living labs” in which users participate in the ongoing development of the solution. As questions are answered, the opportunity is either validated or called into question. Surprises are inevitable and can lead to the discovery of previously unknown or unperceived risks.

In the stamps engagement, risks associated with the proposed technology primarily involved usability issues, but those issues fed back in significant ways into the cost structure of the product. The team experimented with several versions designed to drive costs out without sacrificing usability or fun. Because the product was

intended to be sold through a new channel, we also conducted trials within this channel with mock-ups of the final product to determine whether people would buy it (even before it existed).

For the secure mail engagement, we deployed an early version of the device in our own mailroom, discovered issues with its use and design, and addressed these prior to a weeklong trial at a customer site. The lessons from these trials enabled us to make changes in the design at a point well before extensive engineering efforts had been undertaken.

It is hard to overstate the power of the insights gained during these trials. Even though they are conducted at a stage at which the team believes that it understands the concept very well, there are dozens of issues that relate to the context of use that can only arise during a trial. Often in “brilliant idea” innovation processes, such issues are identified only during an alpha test, after the product has been largely developed. The flexibility to address them at that late stage is greatly limited. Allowing customer-centered testing and refinement to precede product development helps to make the transition from R&D to product development a smooth one.

### **Issues and Challenges**

Although the constraint-driven innovation approach increases the likelihood that new concepts will meet customer needs, provide a differentiated offering, and fit with the corporate context, there are several issues with managing this process. At Pitney Bowes, these issues resulted in some concepts being shelved or discontinued. The most important of these were:

1. **Lack of a fit with the business model.** Although one of the contexts managed in the process is “strategic and operational fit with the corporation,” this was at times difficult to assure. Two concepts that appeared at first to fall into the “sweet spot” on the innovation clover were not taken to market because they would have required new channel development.
2. **Uncertainty regarding market timing.** The customer-centered innovation process uncovers latent needs. The market for filling these needs may need to be developed, and its timing is unpredictable. Uncertainty regarding market timing also contributed to the shelving of some concepts.
3. **Losing focus.** The process is iterative, but sequencing matters. The needs must be understood before ideation can be undertaken; prototypes should be used to validate needs before jumping to value proposition development; value propositions must be developed before building the products to support them. It is easy for teams to lock on to needs or concepts early in the process and consequently lock out information

that conflicts with those early impressions. This tendency to focus on the product as opposed to the process caused delays in some projects.

Our approach to dealing with these issues is threefold. First, we have spent increasing time as the process has evolved seeking early clarity around business and strategic constraints. Unfortunately, some constraints are tacit and become clear only in the context of a specific decision. Second, we rely on extensive user feedback throughout the process in an attempt to increase our comfort level concerning market risks. Finally, we develop approaches for monitoring projects to assure that teams do not get stuck in blind alleys. These approaches help to keep the process on track.

### Conclusion

Managing constraints requires an understanding of the interaction between strategy, corporate capabilities, and customer needs. Promising concepts are not selected from a batch of neat ideas, but emerge from the process of defining and managing the constraints within which an innovation team must work. The crucial task of innovation in this process is evolution, not selection. The goal is to generate, combine, iterate, and morph compelling concepts to meet a variety of concerns, not to weed out weak concepts and hope that a few compelling ideas survive. We have found that such a process greatly increases the flow of new concepts from the innovation function into the business.

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